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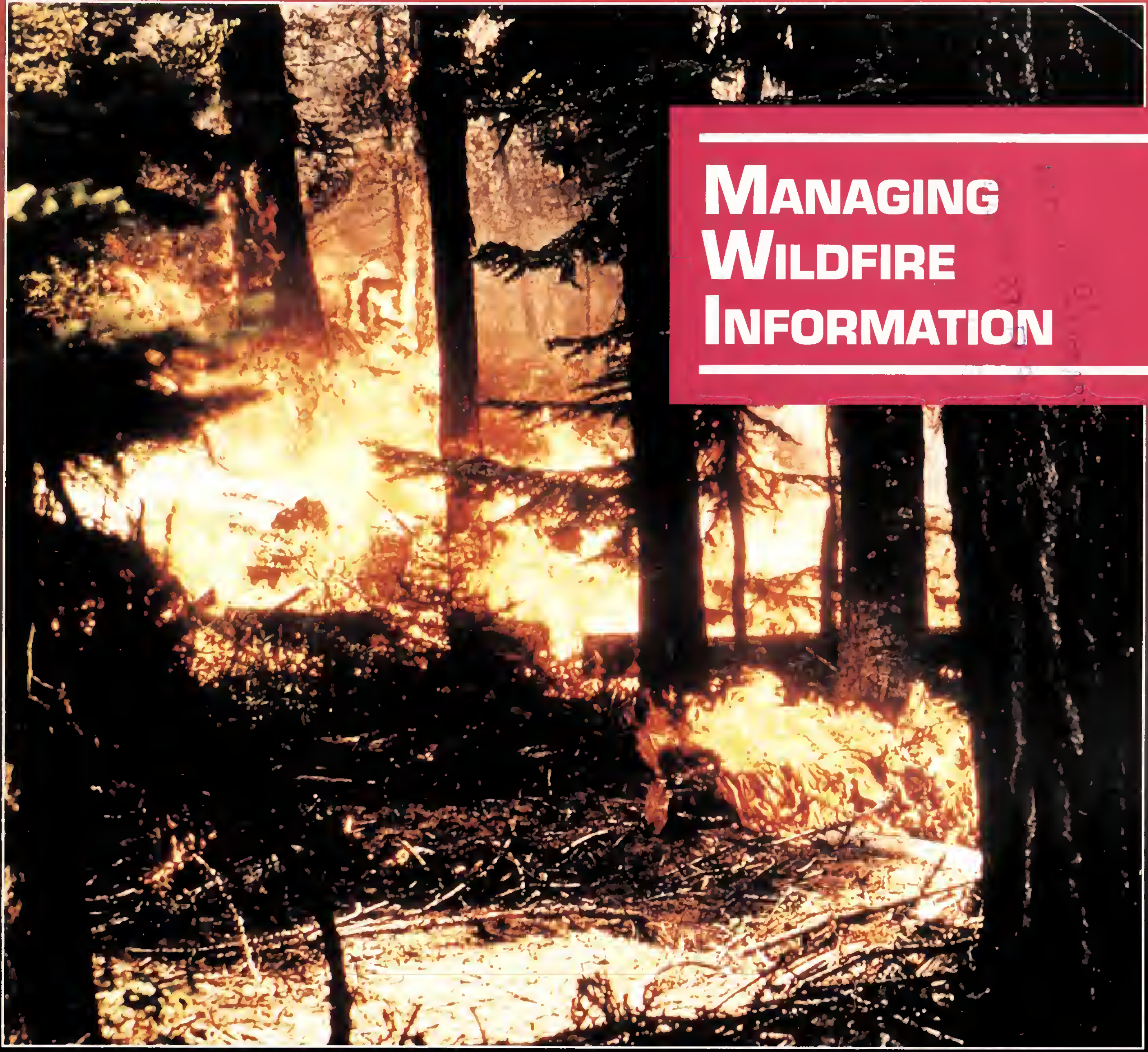
Fire Management *notes*

Volume 55 • No. 2 • 1995



Managing Wildfire Information

United States Department of Agriculture
Forest Service

This issue of *Fire Management Notes* is the second of two that are almost totally devoted to discussions of wildfire management systems. Many thanks to all who communicated to the wildland fire community around the world about the evolution of the shared information environment as well as needs for the future. Special thanks goes to Jayne R. Handley, acting branch chief for Fire Information Systems, and Diana J. Grayson Santos, computer systems analyst, for the USDA Forest Service, Fire and Aviation Management Staff, Washington, DC. They oversaw the submissions and contributed advice and help during the production of both these issues.

Continuity

The last issue prior to this one was *FMN* Volume 55, No. 1—1995. There were no issues published with the 1994 date.

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Fire Management notes

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Contents

Short Features

On the Cover:

Fire and Aviation Management is taking an active role in managing information on fires such as this one on the Colville National Forest, Colville, WA. Photo by Yuen-Gi-Yee.

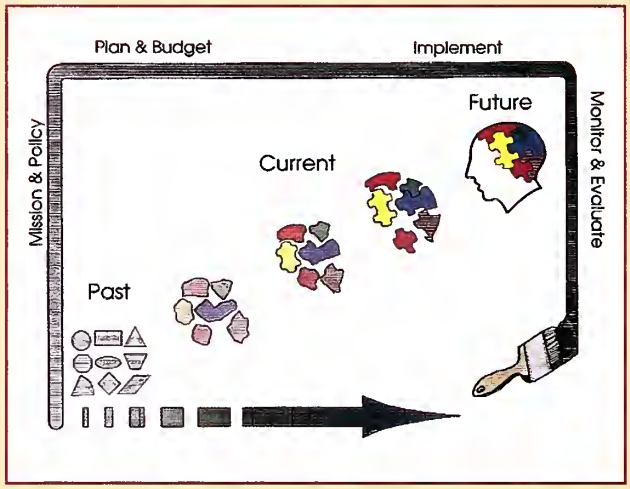
Fire and Aviation Management's Link To Managing Information

Stephen F. Pedigo

In 1992, the Chief of the USDA Forest Service adopted the recommendations in the report "Information Management: A Framework for the Future" (USDA Forest Service Strategic IM Team 1992). The report outlined a vision, principles, ethics, and implementation strategies for developing a shared information environment. Because this environment is critical to realizing the agency's mission, the Forest Service's Fire and Aviation Management (F&AM) Staff is taking an active, aggressive role in implementing the report's recommendations.

Soon after the report was accepted, F&AM chartered the "F&AM Strategy Project." A team made up of representatives of the systems and F&AM communities was assembled in Portland, OR. These people were from all levels of the organization. They represented dispatching, operations, aviation, fire planning, and cooperative fire programs. Using the Computer-Aided Software Engineering (CASE) methodology, this group developed the national strategy and recommendations for the F&AM program. The strategy and its subsequent recommendations are the result of numerous interviews and workshops with members of the fire and aviation community. This "strategy" is the first produced by a Forest Service program and is serving as a model for the agency.

Stephen F. Pedigo is deputy directory for the USDA Forest Service, Rocky Mountain Region, State and Private Forestry, Lakewood, CO.



An illustration of the agency-wide strategy for information management.

As a result of the F&AM Strategy Project and with the support of Mary Jo Lavin, Ph.D., F&AM director, Steve Pedigo became the core team leader for the "Agency Wide Strategy Stage" (AWSS) project under the direction of William M. Bristow II, Forest Service chief information officer. To understand how to get to a shared information environment, AWSS was chartered to develop an "enterprise model" for the agency to describe the primary activities of the Forest Service and the kinds of information needed to support these activities. Recommendations based on this model, an analysis of the agency processes, and an assessment of the current information environment were also developed. An important result of this effort is a definition of "focus areas" for information management. Focus areas group those programs with similar information needs. F&AM is placed in the "protection" focus area.

The final forum for F&AM in information management is the interagency National Wildfire Coordinating Group, which chartered the Information Resource Management Working Team (IRMWT). The IRMWT is currently beginning a strategic interagency information management project to provide the linkage necessary for the fire community to move forward in information management with our cooperators and to provide cost-effective service to our customers.

The National Systems Team is involved in all these efforts to ensure better information service to the entire fire and aviation management community. It is a powerful way to position this community for its future needs.

The world now expects this type of cost-effective, aggressive information planning. It is necessary if we are going to provide timely, accurate information to our programs.

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Weather Information Management System (WIMS)

Mike A. Barrowcliff

The Weather Information Management System (WIMS) is a comprehensive system to manage forestry weather information nationwide. It was designed to accommodate the needs of users throughout the USDA Forest Service and other Federal, State, and local land management organizations. WIMS provides timely access to weather data and related weather information; efficient tools for data management, processing, and display; and a supportive, interactive user's interface with access to data management and data communications facilities.

As part of the effort to manage public lands, the Forest Service, in cooperation with other Federal, State, and private land management organizations, has collected and stored historical weather data from approximately 2,500 weather stations nationwide. This weather data has been used primarily to support fire management activities such as presuppression planning, budgeting, allocating firefighting resources, and providing public information. The previous collection and delivery system for fire weather data was the Administrative and Forest Fire Information Retrieval and Management System (AFFIRMS). AFFIRMS was a command-line driven system first developed and implemented in the late 1960's. AFFIRMS later became the host for the National Fire-Danger Rating System (NFDRS) in 1972 and never really expanded beyond this original function.

WIMS provides up-to-date weather information as well as historical data for analyzing trends.

In 1987, the Forest Service, under the newly created weather program, began taking a more comprehensive look at how weather information could be collected and analyzed to better support resource needs beyond fire management (e.g., ecosystem management, forest health). The Forest Service awarded a competitive contract to conduct an analysis of the agency's total weather information needs and make recommendations on the requirements of a replacement system to efficiently collect and analyze information.

Based upon this study, the Forest Service decided to develop a new system—WIMS—to replace the old AFFIRMS. Another 27-month software development contract was awarded to develop the new WIMS.

An Acquisition Review Team (ART) was formed composed of representatives from the U.S. Department of Agriculture, Forest Service, Small Business Association, and the General Services Administration. The ART followed a parallel review process to select a host-site for WIMS. After an extensive cost-benefit analysis, the USDA's National Computer Center (NCC) in Kansas City, MO, was selected as the most cost-efficient site to host WIMS.

The NCC made numerous arrangements to meet the 7-day, 24-hour operating requirements necessary to support the needs of fire management. The NCC created a Logical Partition (LPAR) on its IBM mainframe to completely isolate WIMS from the rest of its systems. In addition, numerous administrative changes were made to accommodate not just the Forest Service, but all the other cooperating Federal, State, local, and private users of the system. WIMS was made available on the production system at the NCC on April 19, 1993.

Telecommunication links at Kansas City allow direct communication between WIMS and the National Weather Service (NWS) via its NWS Telecommunications Gateway (NWSTG). WIMS accepts selected products (text and graphic), forecasts, and special fire weather forecasts sent by the NWS through the gateway. WIMS also transmits periodic weather observation and fire-danger rating bulletins to designated NWS offices via the gateway.

Mike A. Barrowcliff is a systems analyst for the USDA Forest Service, Fire and Aviation Management, Washington, DC.

Continued on page 6

Another communication link allows WIMS to receive Remote Automatic Weather Station (RAWS) observations from the Bureau of Land Management (BLM). The RAWS data is sent via satellite from automated stations to more accurately measure the weather conditions in remote areas. This data (approximately 850 stations) is used in combination with another 900 manual weather stations to help predict fire-danger ratings throughout the United States. WIMS makes all this weather data available to users in near real time. WIMS also has the capability to accept weather observations from nonsatellite RAWS stations via direct dial-up access.

WIMS is currently hosted on an IBM mainframe (3090), utilizing Oracle's Relational Data Base Management System (RDBMS) and associated tools (SQL*Forms, SQL*QMX, etc.). WIMS also utilizes a transaction-based operating system (CICS) and custom menu interface written in "C" to accommodate up to 100 concurrent users. WIMS is accessible via FTS2000 direct dial-up and/or X.25 packet-switched service to the NCC. Although any 3270-terminal emulator can communicate with WIMS, file transfer is currently supported only on the Data General minicomputer (MV-series) and the personal computer (using SimWare's SimPC application). Currently, there are over 1,800 logon ID's issued to users from over 18 different Federal (Forest Service, NWS, BLM, National Park Service, Bureau of Indian Affairs, Fish and Wildlife Service, and the Department of Energy), State, and local agencies.

In addition, WIMS users also have access to historical fire weather and occurrence data located in the National Interagency Fire Management Integrated Database (NIFMID). Historically, fire-weather data collected by AFFIRMS was stored in an archaic tape-library data base (National Fire Weather Data Library) at the National Computer Center in Fort Collins, CO, to conduct historical analyses and fire planning. This data, along with the data contained in the former National Fire Occurrence Data Library, was converted to an Oracle-based relational data base structure compatible with WIMS. Users now also have direct access to their historical fire data and applications utilizing NIFMID through WIMS. ■

The logo for WIMS, "a comprehensive system to manage forestry weather information nationwide."

METAFIRE—A Timely, Accurate, and Verified Large-Fire Severity Index

James E. Eenigenburg and William A. Main

Every day, year round, by 2:30 p.m. eastern time, the METAFIRE Information System has assembled three maps of the United States showing those areas at greatest risk of having fires larger than 500 acres (200 ha). One map shows current conditions while the other two present the 24- and 48-hour forecasts (Simard and Eenigenburg 1991). Two USDA Forest Service, North Central Forest Experiment Station fire researchers (Simard and Eenigenburg 1990) developed METAFIRE for the Federal Emergency Management Agency (FEMA). The system is ideally suited for senior fire managers who want to quickly grasp the "big picture." Also available, at the same time each day, are all the numbers that went into creating the three maps. These are intended for middle managers who wish, for example, to determine whether an index is dominated by short- or long-term phenomena.

FEMA uses the METAFIRE Severity Index to justify fire emergency funding requests. In addition, many fire managers use it successfully to support applications for those very funds. Fire managers also use the index to allocate resources and pre-position firefighters and equipment and to present timely prevention programs. Researchers are beginning to use a by-product of METAFIRE—a weather data base covering the entire country, begun in 1987 and added to daily—to analyze the effects of climatic and ecological processes on large fires, specifically to link the METAFIRE system itself to higher resolution atmospheric mesoscale models for assessing regional scale atmospheric impacts on wildland fire severity.

"FEMA uses the METAFIRE Severity Index to justify fire emergency funding requests. In addition, many fire managers use it successfully to support applications for those very funds."

James E. Eenigenburg and William A. Main are, respectively, a computer specialist and a retired computer specialist for the USDA Forest Service, North Central Forest Experiment Station, East Lansing, MI.

Climate Divisions

The METAFIRE Information System generated its first map in 1987. It was based on the standard climate divisions (CD's) developed by the National Oceanic and Atmospheric Administration (NOAA). The NOAA system divides the contiguous United States into 344 CD's—up to 10 per State. During the 4-year development phase, Simard and Eenigenburg refined NOAA's system. They combined some of the smaller CD's, subdivided some of the larger ones, and added Alaska and Hawaii to develop the current 390-CD map. Because METAFIRE uses constant outlines (unlike systems that use contouring), users always know their map location and its associated severity index.

Each CD is uniquely defined by a data base of attributes that affect the various fuel model components, seasonal adjustments, and decision-support-system (DSS) modules:

- Latitude and longitude
- Time zone
- Elevation
- Primary and secondary fuel types
- Climatic region, class, and normalization
- Keetch spring and fall codes for triggering change of seasons

Soil Moisture and Weather Data

Once a week, METAFIRE downloads from NOAA the current soil moisture data for each CD—specifically the monthly moisture anomaly (updated weekly) and the Palmer Drought Index. METAFIRE uses the first of these numbers in the calculation of its long-term component and the second as one of its secondary weather modules.

Five National Weather Service networks are accessed each day:

Continued on page 8

hourly, upper air, synoptic, and the National Meteorological Center's Model Output Statistics (MOS) and Nested Grid Model (NGM) forecasts. Each CD is associated with two hourly stations, two upper air stations, and one of each of the others (except there are no MOS stations in Alaska and no forecast stations of either kind in Hawaii).

System Components

METAFIRE first calculates a preliminary Severity Index (SI), based on six primary system components:

- Spread—1964 National Fire-Danger Rating System (NFDRS) Grass Spread Index (Main 1969)
- Short-term—1978 NFDRS model O Ignition Component (Burgan 1988)
- Upper-air—Haines' Index (Haines 1988)
- Mid-term—1978 NFDRS model O Energy Release Component
- Long-term—NOAA monthly moisture anomaly (the Z-index)
- Season—weather-based module created specifically for METAFIRE that considers green-up, cold temperatures, freezing precipitation, winter, and/or snow on the ground (Simard et al. 1990)

METAFIRE then applies three secondary weather modules:

- Sub-threshold—adjusts the SI when most of the primary components are just below (or far below) triggering thresholds
- Overnight recovery—adjusts the SI when overnight humidity is high
- Palmer drought—adjusts the SI for unusually wet or dry soil moisture

Finally, there are three DSS modules that further "tweak" the METAFIRE Severity Index:

- Spatial analysis—compares each CD to its neighbors
- Temporal analysis—looks at how each CD progressed over the last 3 days
- Profile analysis—compares the components for each CD against the seasonal profile of one in danger of having an extreme fire

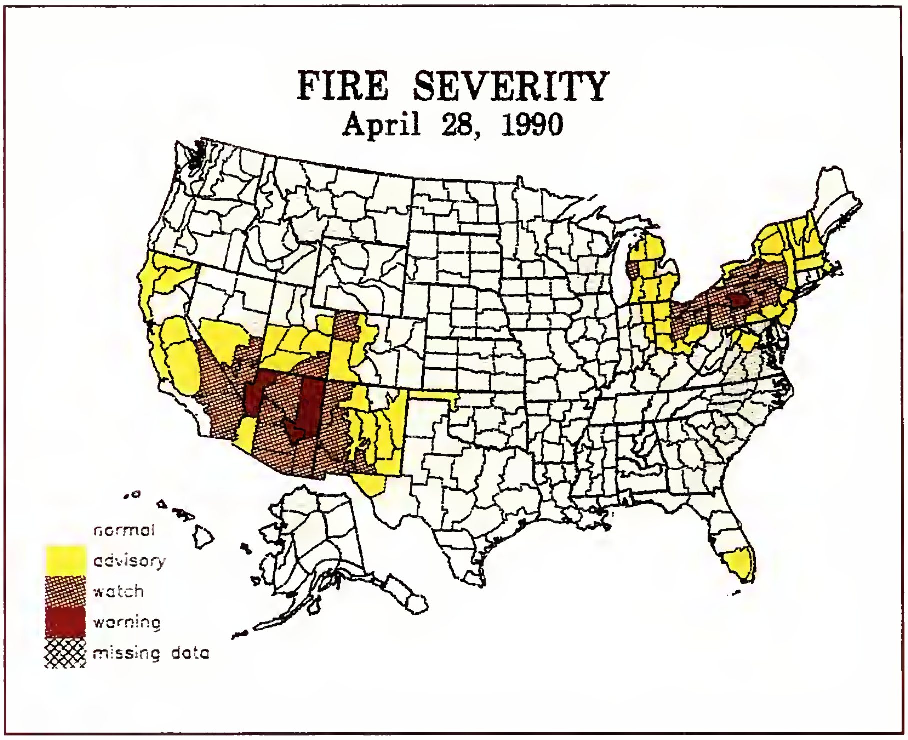

Figure 1—*METAFIRE targeted the Northeast with a "bull's-eye" over the largest Pennsylvania fire in 55 years.*

Accuracy

How accurate is METAFIRE? Because the purpose of METAFIRE is to identify those CD's where conditions are right to have an extreme fire, not having a fire does not necessarily mean that METAFIRE failed. During the evaluation period of July 1987 to June 1991, we found that 1 CD in 60 of those CD's at the advisory level actually had extreme fires. At the watch level, the odds increased to 1 in 20; at the warning level it was 1 chance in 14. METAFIRE correctly predicted 83 percent of the large fires (500+ acres (200+ ha)) that actually occurred (fig. 1). METAFIRE

"cried wolf" on only 13 percent of the days per average CD. It was designed to identify the worst 10 percent of days, but the excessively dry 1988 and 1989 years in the data base pushed the bad day count up slightly.

Access

How can fire managers get METAFIRE? First, you need an IBM-compatible personal computer with a modem. Second, you need an account with WeatherBank, Inc., of Salt Lake City—a commercial weather provider that has been including the METAFIRE maps and data on its dial-up bulletin board since 1991. Call 801-530-3181 to set up your WeatherBank account. METAFIRE is only one of many forest-fire-danger, lightning, and weather products that WeatherBank provides. The computer software and manuals they furnish are very easy to follow. (See box for specifics on selecting METAFIRE from WeatherBank's menus.)

If you want more information, contact Jim Eenigenburg; North Central Forest Experiment Station; 1407 S. Harrison Rd, Room 220; East Lansing MI 48823-5290; tel. 517-355-7740; FAX 517-355-5121.

Accessing METAFIRE

There are three kinds of METAFIRE products available on WeatherBank's bulletin board. First, there are the METAFIRE severity maps (today's, tomorrow's, and the next day's). These can be found by selecting "Color Weather Maps," and then selecting "Specialty" from the bulletin board menus. The three maps are among those listed.

The other two kinds of METAFIRE products can be retrieved by first selecting "Interactive Products." This opens a window permitting the user to type in the name of a product desired. Typing just the four-letter word "meta" (and pressing F3 to activate) will provide the user with the three METAFIRE severity reports that parallel the three maps.

To retrieve the third product, in the "Interactive Products" window, type the word "meta" followed by a space and a date (in the form yymmdd). This will provide the archive file of all 36 variables that went into figuring the final METAFIRE numbers for all 390 CD's. This information may be useful to the fire manager who wants to know why the CD's in his/her district showed up as "warnings."

The archive files are large—the user may shorten the transmission time considerably by selecting only the States of interest. For example, the command "meta /az/nm 940415" will produce just the Arizona and New Mexico data for 4/15/94 (note there are no spaces between the State abbreviations). The data are provided with short and perhaps cryptic column headers—the user can retrieve a description of these headers by requesting the interactive product "meta metaarcv."

The work involved in setting up the retrieval of the severity maps and reports would have to be done only once—the fire manager can set it up so that if the computer is on, everything is done automatically, even when no one is there!

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Monthly Fire Weather Forecasts Now in Color

Morris H. McCutchan, Bernard N. Meisner, Francis M. Fujioka, John W. Benoit, and Benjamin Ly

Now available in color via modem, monthly fire weather forecasts can provide fire managers with a quick and easy planning tool. Researchers at the Fire Meteorology Research Work Unit in Riverside, CA, prepare the forecast package that is based on the monthly forecast of 700 millibar heights issued by the National Weather Service Climate Prediction Center in Washington, DC. The forecasts are not the fire planner's magic bullets, but they do provide scientifically based, long-range forecasts. Because these forecasts are inherently less accurate in the long range than in the short range, the user must consider the impact of variable forecast accuracy. Where average weather conditions may vary rapidly over short distances, as in complex terrain, the scale of these forecasts may be too coarse to capture such variations accurately. For more details on the monthly forecasts, see McCutchan et al., 1991.

> "Monthly fire weather forecasts are not the fire planner's magic bullets, but they do provide scientifically based, long-range forecasts."

Monthly Fire Potential and the Chandler Burning Index

A fire weather forecast characterizes the weather-induced fire potential for the continental United States as an average during a particular month. The color maps depict percentiles that are similar to those derived in the National Fire-Danger Rating System. Higher percentiles indicate higher fire potential. The monthly fire potential is represented by a modified version of the Chandler Burning Index (CBI) (fig. 1). The CBI provides monthly measures of fire intensity and rate of spread (not the same as NFDRS rate of spread: see Chandler et al. 1983). The intensity component of the CBI is linearly related to temperature and relative humidity (i.e., an increase in temperature results in a proportionately higher index), but the spread component is exponentially related to relative humidity (i.e., a small decrease in humidity results in a large increase in the index). It is computed from:

$$\text{CBI} = ((110 - 1.373H) - 0.54(10.20 - T))\,(124 \times 10^{-0.0142H})/60$$

where H = forecast monthly mean afternoon relative humidity (percent)
T = forecast monthly mean afternoon temperature (degrees Celsius)

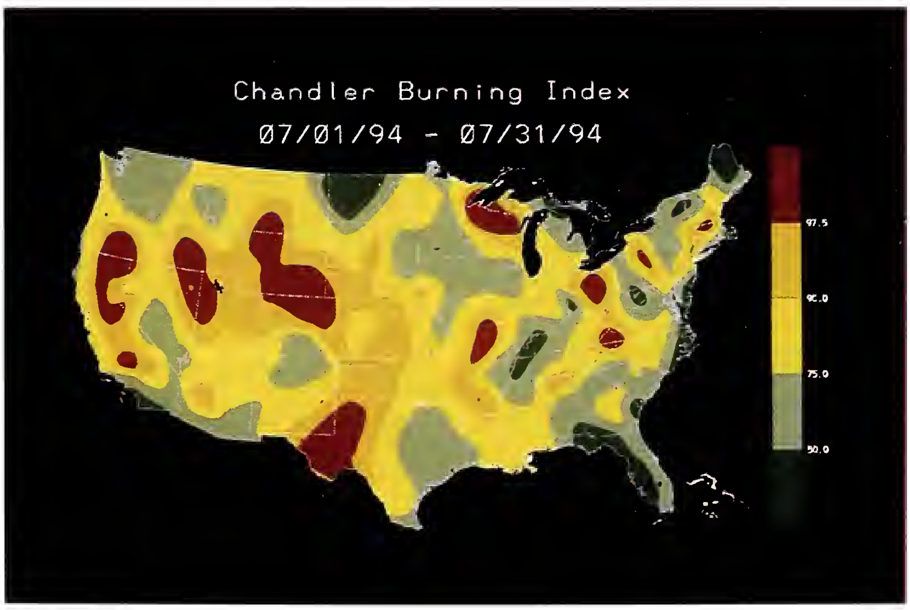

Figure 1—*Map of forecast percentiles for July 1994 for the average, afternoon-modified Chandler Burning Index.*

Morris H. McCutchan, Bernard N. Meisner, and Francis M. Fujioka are research meteorologists and John W. Benoit and Benjamin Ly are computer programmers for the USDA Forest Service, Pacific Southwest Research Station, Riverside, CA.

The CBI has been shown to be highly correlated with monthly fire activity (McCutchan and Main 1989) and the accumulated Energy Release Component.

Monthly Fire Weather Forecast Bulletin Board

The forecasts consist of five color maps, two tables, and a narrative discussion. The color maps are: average afternoon modified CBI, average afternoon temperature, average afternoon relative humidity, average afternoon windspeed, and precipitation frequency. These maps are in the Graphical Interchange Format (GIF)[1]. Shareware programs to display and print the color maps using either DOS or Windows are also available for downloading. The forecasts are updated by the first and fifteenth days of each month. The telephone number of the fire-weather-forecast computer system is 909-276-6563. Communication parameters are 8 data bits, no parity, and 1 stop bit. Transmission rates of 300 to 14,400 baud are supported. The forecasts may be downloaded using X-modem, Y-modem, or Z-modem protocols. The forecasts are also accessible at

http://www.rfl.pswfs.gov/index.html on the World Wide Web. For more information on downloading the forecasts, telephone Benjamin Ly at 909-276-6354.

[1]GIF was developed by Compuserve. Many graphics programs allow users to input GIF files for viewing and printing.

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Guidelines for Contributors

Editorial Policy

Fire Management Notes (FMN) is an international quarterly magazine for the wildland fire community. *FMN* welcomes unsolicited manuscripts from readers on any subject related to fire management. (See the subject index of the first issue of each volume for a list of topics covered in the past.)

Because space is a consideration, long manuscripts are subject to publication delay and editorial cutting; *FMN* **does** print short pieces of interest to readers.

Submission Guidelines

Authors are asked to type or word process their articles on white paper (double-spaced) on one side. Try to keep titles concise and descriptive; subheadings and bulleted material are usual and help readability. As a general rule of clear writing, use the active voice (e.g., Fire managers know . . . **not** It is known . . .).

Submit articles to Donna M. Paananen, Editor; *Fire Management Notes;* USDA Forest Service; North Central Forest Experiment Station, 1407 S. Harrison Road, Room 220; East Lansing, MI 48823-5290; telephone 517-355-7740.

Complete name(s) and address(es) of authors as well as telephone and FAX numbers should be included with the paper copy submission. If the same or a similar article is being submitted elsewhere, that information should be also be included.

Writers with access to the USDA Forest Service's Data General (DG) computer system should also submit their articles electronically to D.Paananen:W01C. Disks should be submitted with the paper copy. *FMN* prefers any version of WordPerfect or ASCII text file on IBM/Dos-compatible disks. It also is possible to transfer Macintosh disks. Please label the disk carefully with system being used and name of file. If illustrations have also been created electronically, please submit a disk with them and label appropriately.

Consult recent issues for placement of the author's name, title, agency affiliation, and location as well as style for paragraph headings and references. *FMN* uses the spelling, capitalization, hyphenation, and other styles as recommended by the U.S. Government Printing Office "Style Manual." Inhouse editing can be expedited if authors have their article reviewed by peers and by someone with editing skills. Please list those reviewers.

Authors are asked to use the English unit system of weight and measure, with equivalent values in the metric system. Tables should be typed with titles and column headings capitalized as shown in recent issues; tables should be understandable without reading the text. Include tables at the end of the manuscript.

Figures and illustrations (black ink drawings when applicable), and slides and clear photographs (preferably glossy black and white prints) are often essential to the understanding of articles. On the back, please label carefully (Figure 1, Figure 2; photograph A, B, C, etc.). Also include your complete name and address if you wish your material returned, and indicate the "top." Clear, thorough captions (see recent issues) should be labeled to correspond with these designations.

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Fire Managers Need GIS Applications

Lucy Anne Salazar

Wildland fire managers and planners rely heavily on information that describes environmental and sociological factors. Complex and dynamic interactions among these factors are commonplace, but difficult to analyze manually and portray in a useable and understandable way. A geographic information system (GIS) is comprised of software, hardware, data, and operating principles and procedures necessary to process spatial data. This technology provides a new way to visualize, analyze, and communicate important spatial relationships in natural resources. Fire managers are rapidly discovering how GIS can help them in decisionmaking. Areas in which GIS technology is already being used include:

- Fuel management
- Wildfire prevention
- Wildfire detection
- Presuppression activities
- Dispatching crews and equipment
- Suppression activities
- Wilderness fire management

Fuel Management

Fuel management planning involves decisions regarding the placement, frequency, priorities, and types of fuel treatments. When deciding on the placement of fuel treatments, a number of spatial factors may be involved, including:

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GIS provides the technology to analyze and model vast amounts of data for planning and real-time decisionmaking.

- Administrative boundaries
- Topography
- Vegetation types
- Fuel loadings
- Sensitive wildlife habitats
- Previous prescribed burns or wildfires
- Wind profiles
- Soil types
- Building densities
- Access routes
- Stream systems
- Permanent study plots
- Natural firebreaks
- Power lines

It would be impossible to manually or mentally integrate these various factors. Fire managers can use GIS software to sift through the data and highlight the locations that fit the selected, desirable characteristics for establishing prescribed burns, fuelbreaks, and areas that are mechanically or hand cleared. They can also integrate this information with benefit and cost analyses to select which fuel treatment alternative is best for the situation. Finally, they can use this type of analysis to determine whether previous fuel treatments were consistent with stated fuel management objectives (McKinsey 1988).

The data base management system (DBMS) of a GIS can be used for fuelbreak maintenance scheduling or for monitoring fuel succession within prescribed burns. Managers select fuel treatments for multiple resource benefits beyond hazard reduction. The DBMS can help to better determine costs and benefits (and their allocation) based on the environmental input data, in combination with other modeling efforts, e.g., wildlife habitat models or water yield models. An up-to-date DBMS will also allow more frequent updates to fuel management plans. For example, yearly updates can be made to reflect significant changes that occur, such as major wildfires, increased urban development, or budget changes.

Wildfire Prevention

Prevention personnel regularly deal with the interaction of environmental and societal factors. They are interested in where fires have historically started, fuel conditions along access routes, locations of buildings, landscaping conditions around homes, and the placement of recreational facilities. GIS can be used to integrate data on past fire histories, topography, access routes, and vegetation types to determine relative hazard levels. Patrol schedules and route designs could also be based on these hazard ratings. The location of hazardous areas can also have an effect on the approval and extent of building development and zoning restrictions within or adjacent to the wildland areas. Scheduling and

monitoring of prevention inspections can also be performed with the DBMS. Prevention personnel can give homeowners background on low-growing, fire-resistant, or drought-resistant plants, based on these plants' inherent growing conditions, such as elevation or soil type. Through the use of a GIS and an expert system, Crowders Mountain State Park in North Carolina was able to improve the efficiency of its fire prevention program by removing burdens of spatial data handling, management, and modeling encountered with manual methods (Gronlund et al. 1994).

Wildfire Detection

The three-dimensional modeling process of a GIS uses topographic information to determine visible areas from selected points. This information can be combined with analyses of past fire occurrence, fuel hazard, and resource values to define strategic locations for fixed lookouts. Output from Automated Lightning Detection Systems (ALDS) can be directly fed into a GIS. It is still difficult to determine which of the strikes will produce a fire, but the data could still be used for lightning density analysis (Fujioka and Dean 1989, van Wagtendonk 1993). In areas where haze is a problem, the elevation of the inversion layer can be added to the three-dimensional GIS software, showing where an established lookout may be ineffective on hazy days.

Presuppression Activities

Because presuppression activities occur before a fire starts, a great deal of information is needed to make adequate plans, including:

- Previous fire locations
- Building densities
- Interaction of wildfires
- Fire behavior potentials
- Proposed locations for firelines
- Potential fireline production rates
- Crew locations
- Previous fuel treatments
- Access routes and travel times along them
- Power line locations
- "Viewsheds" from strategically located observation points

Network analyses can be used to perform pathfinding and optimal allocation operations (Lupien et al. 1987). For example, network analyses can determine:

- The minimum-cost path between two points
- The optimal centralized location for a guard station or a staging area
- Which center should respond to a fire report

The National Fire Management Analysis System (NFMAS) is currently used to identify annual fire programs and budgets, with the objective of long-term economic efficiency (Brandel 1988). The GIS and its data base will help the NFMAS process by making it more site specific and by providing a better process for trying "what-if?" situations. Spatial statistics can be used in presuppression planning to evaluate alternative management plans, design cost-effective spatial strategies, and provide information necessary for quick-response decisions during fire suppression (Chou 1992).

Vegetation greenness is mapped weekly at 1-km resolution for the conterminous United States. These GIS products are useful to fire managers in estimating broad area fire potential and for managing prescribed fires (Burgan and Hartford 1993). Fire behavior modeling of rates-of-spread and fireline intensities can also be done with a GIS on a finer scale, using local weather inputs, fuel models, and topographic inputs (Salazar and Power 1988, Finney 1993). Patterns of wind fields can be determined by integrating wind models with the GIS data base (Zack and Minnich 1991).

Training can also be improved by using a GIS. New crew members or those from outside an area can become familiar with the forest through fire simulations using the GIS data base. They can see what they might typically encounter in wind patterns, topography, fuel conditions, or escape routes during a wildfire in a certain area without endangering themselves.

Dispatching Crews and Equipment

The Okanogan National Forest in northern Washington developed a computerized dispatch system using a GIS (Gum 1985). Their initial attack decisions were based on inputs from

- The Automated Lightning Detection System
- Fire weather from remote automated fire weather stations
- Fuel models
- Land management objectives
- Current and potential productivity mapping
- Inherent value-at-risk assessments
- Priority guides
- Fire-weather seasonal predictive guides
- Slope classes
- Aspect
- Elevation
- Crown closure
- Vegetation by species and size class

Continued on page 14

Further refinement could be made by including network analysis to determine allocation centers or optimal paths between selected points. Topographic distances can also be included along these routes to include slope effects on arrival times and speeds.

Suppression Activities

Suppression uses will probably be the most taxing for the GIS and its users because of the real-time nature of the hazardous situations that will be involved. Much information that has already been mentioned will also be of interest to suppression personnel, including:

- Building densities and descriptions
- Weather and erratic wind patterns
- Vegetation types and fuel loadings
- Topographic conditions
- Crew placement
- Locations of water sources
- Access routes and travel times along them
- Power line locations.

This information will need to be in a resolution that is fine enough to be useful for devising suppression strategies. A GIS was used to process and display the daily growth of the 1988 fires in the Greater Yellowstone Area from June 14 to October 1 (Rothermel et al. 1994). The fire maps integrated information and data from daily infrared photography flights, satellite imagery, ground and aerial reconnaissance, command center intelligence, and the personal recollections of fire behavior observers.

The dynamic aspect of some features (e.g., wind patterns, crew locations) will also need to be incorporated into the GIS data base scheme. Managers could model fire behavior by using inputs of fuel models, topography (see fig. 1), and weather. Interactive ties of the BEHAVE fire modeling system (Andrews 1986) with a GIS data base have been created through the FARSITE (Fire ARea SImulator) fire growth model (Finney 1993). In addition, calculations of the potential for crowning and spotting could help in long-term strategic placement of crews and equipment.

GIS technology has been shown to be useful in rehabilitation efforts following a major wildfire in southern Oregon. A 2-1/2-month effort used digital data on soils, watershed sensitivities, visual information, roads, streams, and fire intensities to draft an environmental impact statement and management strategies for rehabilitation on the Siskiyou National Forest (Drisbow 1988).

A GIS could provide benefits to the National Interagency Incident Management System (NIIMS), which is a total systems approach to all-risk incident management. The Incident Command System (ICS), a NIIMS subsystem, could use a GIS in all of its functional areas, but especially in the areas of command, operations, and planning. NIIMS already has a built-in subsystem, Supporting Technology, that could tie GIS and supporting technology into the overall NIIMS structure. Once ICS is interfaced to the GIS, the Documentation Unit could use information accumulated and stored during the incident to automatically fill out the 5100-29 fire report form.

Wilderness Fire Management

Recent extreme fire seasons have put increased emphasis on wilderness fire management. The Wilderness Act (1964), which specifies that designated wilderness areas be "managed so as to preserve natural conditions," results in special fire management policies. For example, lightning-caused fires are allowed to play their natural ecological role within wilderness boundaries. The GIS could display

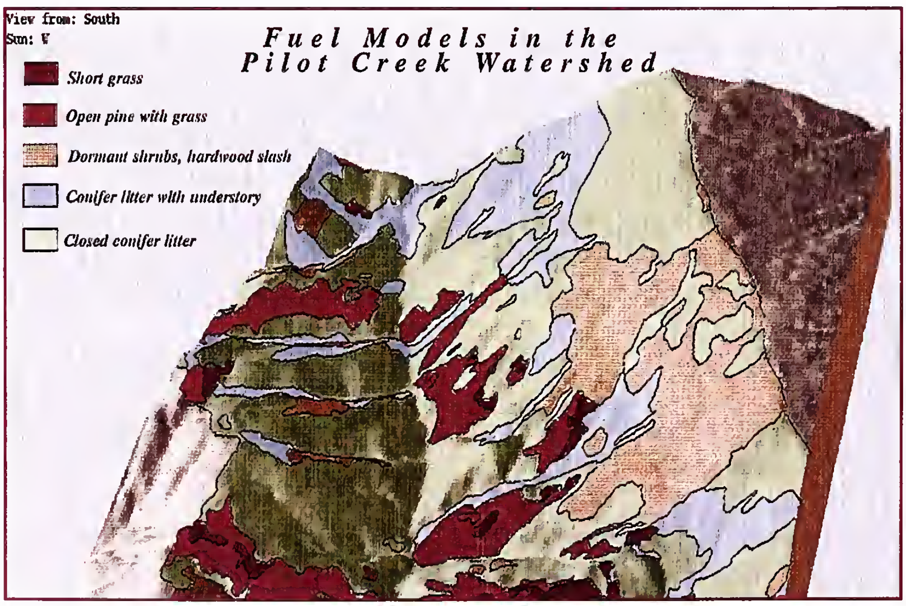

Figure 1—*GIS can analyze data to provide information on fuel models and topography such as shown in this 3-dimensional map of the Pilot Creek Watershed on the Six Rivers National Forest.*

and monitor lightning strike densities to help determine whether the fires started by lightning will be far within, bordering, or just outside the wilderness boundaries. Different strategies would be required for each type of strike location. Wildfires do not respect wilderness boundaries, so information about surrounding ecosystems is very important to wilderness fire managers. A GIS will allow managers to share information and incorporate "off-site" data into planning decisions.

Managers could also use fire behavior predictions, generated with GIS inputs, to help them decide on evacuations or trail closures. Visitor maps can also be generated, showing updates on fire perimeters (van Wagtendonk 1986).

In wilderness areas, preference is given to using methods and equipment that cause the least:

- Alteration of the wilderness landscape
- Disturbance of the land surface
- Disturbance to visitor solitude
- Reduction of visibility during periods of visitor use
- Adverse air quality (USDA 1990)

GIS can be used in selecting these preferred methods or for locating "low-impact" helispots or fire camps that, out of necessity, have to be within the wilderness boundaries.

Wilderness fire planning must address environmental concerns and public involvement inputs in order to identify issues, concerns, and management opportunities. Fischer's (1984) checklist regarding wilderness assessment includes a variety of data that a GIS can store, including soil erodibility, archaeological resources, streamflow regimes, rights-of-way, wildlife and fisheries habitats, water rights, energy sources, and population distribution and density.

Conclusion

Ecosystem management at a landscape scale has become the driving force behind natural resource management. Fire managers are vital players in this long-term task, especially when dealing with the complex and escalating issues of wildland-urban zones, multiagency cooperation, and environmental concerns. A GIS provides an efficient tool that can integrate and analyze large geographic data bases and produce information useful for fire planning and real-time decisionmaking.

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ALMRS Platform Leads BLM Fire Into an Integrated Future

Karen Miranda

Development and implementation of the Automated Land and Mineral Record System (ALMRS) at the Bureau of Land Management (BLM) has been in full swing since the contract was awarded to the Computer Sciences Corporation (CSC) in April 1993. The 10-year award has a potential value of up to $400 million.

ALMRS automates and integrates BLM's business processes and record-keeping functions, including its Fire Management System, onto an integrated hardware and software platform. It includes an associated operating system, data base management system, spatial data management capabilities, office automation capabilities, and enhanced telecommunications. While improving BLM's efficiency, ALMRS also makes BLM's records available electronically to local, State, and other Federal agencies; private industry; and the public.

First Phase of ALMRS

The first phase of ALMRS replaces BLM's outdated administrative systems, currently located on the Honeywell DPS8000. During 1994 and 1995, new automated data processing hardware and commercial, off-the-shelf (COTS) hardware will replace the old at almost 200 BLM sites—including the National Interagency Fire Center (NIFC) at Boise, ID. This phase involved rehosting 15 BLM administrative systems and re-engineering the NIFC Fire Management System. That system, which compiles and tracks BLM wildfire incident reports, fire-cost data, and fire-planning information, was tested on the new ALMRS platform in May 1995.

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> ALMRS updates the BLM's Fire Management System and takes a step forward toward interagency compatibility.

The ALMRS hardware platform consists of IBM's RISC System/6000 workstations and multiuser central processing units (CPU's), X-terminals, and PC's with X-terminal emulation capabilitiy. These will run on the UNIX AIX Version 3 operating system and Informix's INFORMIX relational data base management system.

Office automation software for ALMRS includes IBM's AIX Windows Desktop, Applix's Asterix, and WordPerfect systems for word processing, spreadsheet, Groupwise E-mail, and presentation graphics. There are also electronic mail, calendar/scheduler, statistics, project management, and desktop publishing packages provided by various corporations, as well as Local Area Network (LAN) and Wide Area Network (WAN) capabilities.

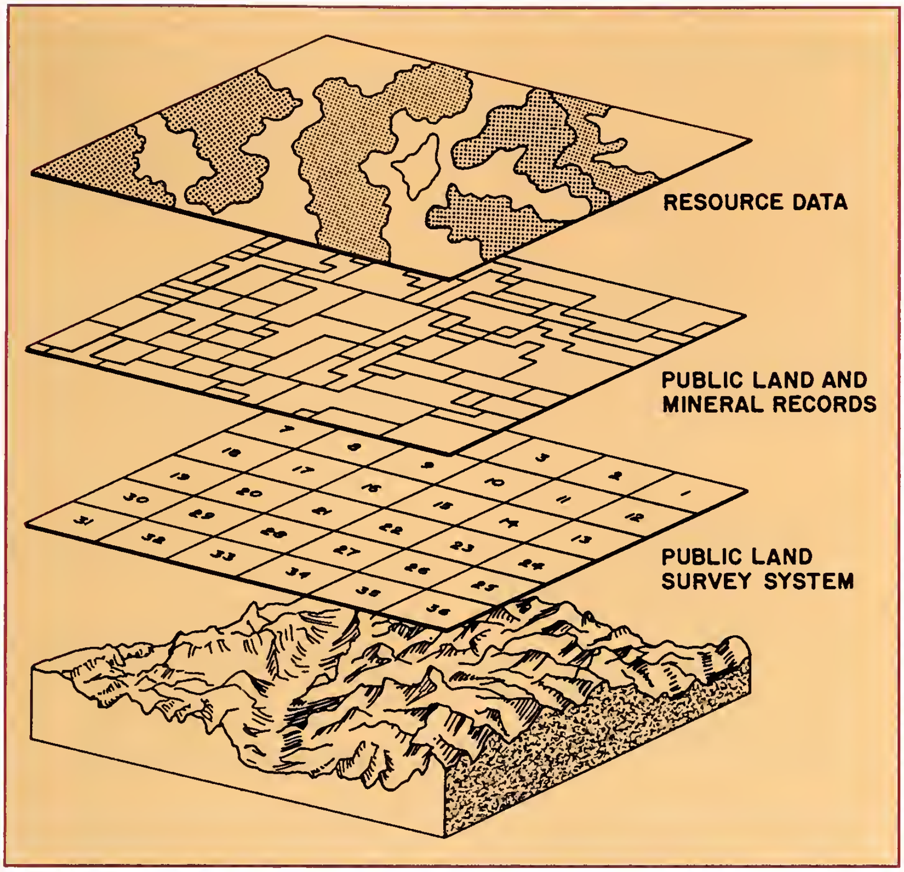
ALMRS geographic information system (GIS) capabilities include ESRI's ARC/INFO for spatial information processing and ERDAS's IMAGINE for image processing.

Second Phase of ALMRS

During the second phase of ALMRS, called the ALMRS Initial Operating Capability (IOC), data base software will be installed to modernize and automate over 1 billion paper records that have been disintegrating over the past 200 years. These land and mineral records include the official Public Land survey records of the United States and form the legal basis for Federal land management decisions.

Third Phase of ALMRS

ALMRS IOC will combine two types of information onto one system. The first type is land identification, ownership, and authorization records—including property rights, use permits, and oil and gas leases. These records are derived from land and mineral case files, entered into separate automated data bases during the 1970's and 1980's. The second type is data from legal land parcels, as defined by the Public Land Survey System. These spatial data are being collected and automated to form the Geographic Coordinate Data Base, which uses latitude and longitude



BLM's Land Information System.

to tie map information to specifications on the ground.

Is ALMRS Compatible With Other Systems?

Two other BLM fire systems—the Initial Attack Management System (IAMS), which includes the Computer-Aided Aviation Hazard Information System (CAHIS), and Initial Attack Analysis (IAA)—are not included on ALMRS. When the specifications for ALMRS were being developed in the early 1980's, a special exemption was given to allow all technical services, Computer-Aided Drafting, and IAMS to be updated onto a new hardware platform, which was needed several years before ALMRS would be implemented. IAA operated originally on the IAMS platform before being rehosted to personal computers several years ago. BLM officials are actively studying the compatibility of IAMS and IAA with ALMRS in Denver, CO (BLM's Denver-Washington Office), at BLM's Washington, DC, Office Headquarters, and at NIFC in Boise, ID.

On a larger scale, the compatibility of different fire systems is also being addressed within the United States Department of the Interior (USDI) as a whole, with development of an integrated fire management system for USDI agencies. The USDI effort, spearheaded by the National Park Service (NPS), will integrate fire-related systems from the NPS, BLM, Fish and Wildlife Service, and Bureau of Indian Affairs onto one main SUPERVACS digitally based platform. In addition to one common hardware platform, the USDI system will include a common core set of software, with flexibility for each agency to modify, develop, and enhance software to meet its own organizational requirements.

"We're taking steps toward an integrated platform, and we're getting closer to that goal all the time," said John Gebhard, BLM's Fire and Aviation Coordinator for the National Headquarter's Office at NIFC. Gebhard is also chairperson of the National Wildfire Coordinating Group (NWCG) Information Resources Management Working Team, tasked to develop strategies for automation. NWCG's vision for the future includes the eventual integration of the USDI system—including the fire systems of ALMRS—with Forest Service, State, and private systems to create a unified system for the fire community as a whole. ■

Experiences With InciNet

William de Graaf, Jr.

The first time I heard of the Incident Command Network (InciNet) was August 14, 1992. I had just moved from managing the local area network for the Washington Office of the USDA Forest Service to the Fire Planning and Systems Section. My new title was computer systems analyst. My responsibility for InciNet was as "liaison."

In my desk were many folders containing letters, pictures, articles, and contact names. In one folder was an "audit" of the InciNet project. From that point, my questions started. What is InciNet? What does the role of liaison involve? Why was there an "audit?"

Phone Calls Produce Many Answers

To get answers to my questions, I telephoned various people listed in the "audit." I asked each one, "What is InciNet?" Following is a sampling of the answers:

- "InciNet is a computer program that allows communications between incidents and the Forest Service's computer system."
- "InciNet is a tracking system started by Fiscal for tracking resources."
- "InciNet is a computer network set up at the site of an incident to allow communication between the different units."

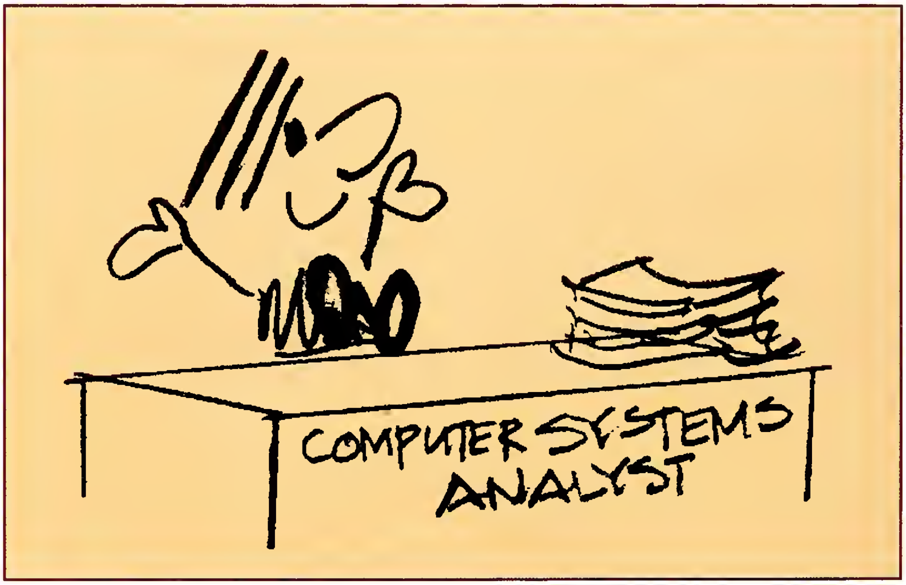
> " . . . InciNet means something different to each agency that uses it."

- "InciNet is an automated system for planning the attack on fires."
- "InciNet is a highly advanced incident data base."
- "InciNet is an interagency information management project."
- "InciNet is state-of-the-art equipment. It is used to replace the 'DAC' kits."
- "InciNet is a California Department of Forestry and Fire Protection (CDF) project that the Forest Service and the Bureau of Land Management bought into."
- "InciNet is an operations project."
- "InciNet is a systems project."
- "Boat anchors!"

"Interesting," I thought. I had talked to about 20 people, completed close to 15 hours of conversations, and I was still confused.

When I asked about the reasons for the audit, the answers I received were equally perplexing:

- "An audit was done to get this program back on track."
- "An audit was done because "X" and "Y" were not doing their jobs."
- "An audit was done to find out why we don't have a product yet."
- "The audit was to make our wishes heard."
- "An audit was done because 'Q' wanted it."



"When I was named to the InciNet 'blitz-analysis' team, I decided to pay my predecessor a short visit."

William de Graaf, Jr., is a computer systems analyst for the USDA Forest Service, Fire Planning and Systems, Washington, DC.

Visit to Former Analyst

When I was named to the InciNet "blitz-analysis" team, I decided to pay my predecessor a short visit. Maybe he could help. I was impressed with the size of his office. "Maybe InciNet is good for one's career," I thought. "Then again, maybe it is a good reason to switch jobs?" I became a little worried.

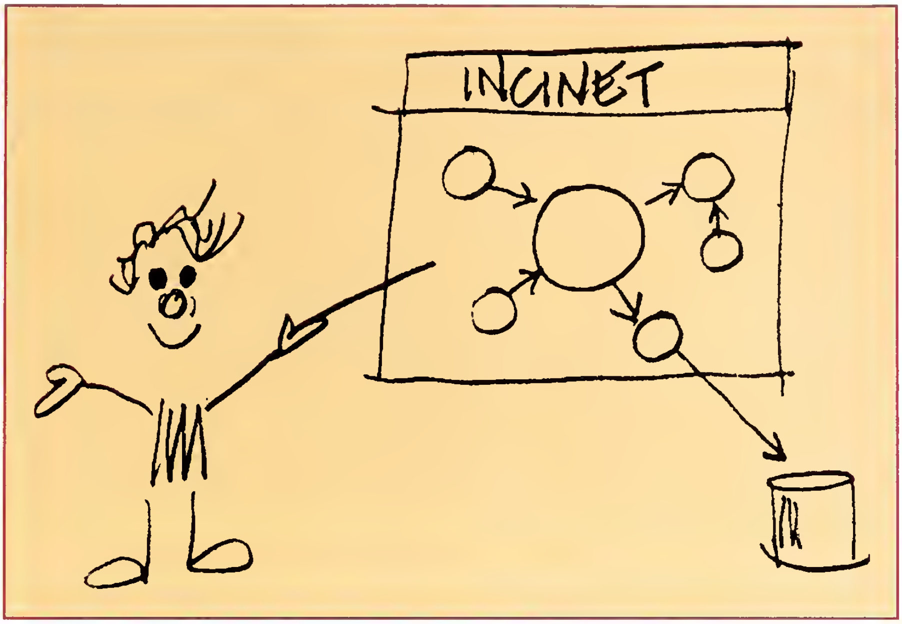
He smiled as I sat. "It must have been a good change for him to switch jobs," I mused.

He leaned back in his chair and asked, "How can I help you?" He was still smiling.

I voiced my frustration by asking him the question, "Can you tell me what InciNet is?"

"Jell-O," he replied. He went on to explain that InciNet means something different to each agency that uses it. Additionally, each agency has its own idea on how to approach automating the Incident Command System (ICS).

"Jell-O." What he had said made sense. Maybe I was looking at the answers incorrectly. It seemed I was looking for an agreement among all parties on the nature of InciNet. An agreement is not going to happen when organizations use InciNet in their own unique way. Furthermore, different branches within an organization view InciNet differently. In addition, various individuals within each branch of the organization were looking to InciNet to solve their own unique problems.



"I began to see how complex, yet flexible, ICS is and how it can grow."

Visit to Key InciNet Users

Several weeks later, I made my first trip to Sacramento, CA, to meet the "key" players in the InciNet project. As I look back on that meeting, I realize that I took away more than I brought.

While I had done analysis in graduate school, I had never participated in an analysis of a computer system. In talking with the participants of the program, it became clear to me that they had their own ideas on where this analysis should go. I became concerned. I thought analysis was something done **before** a project. Why were we carrying on an analysis after the fact? Additionally, this was a "blitz analysis," meaning incomplete, high level, and done quickly. After the first day, where I saw the Computer Assisted Software Engineering (CASE) tool, used for analysis, "eat" important concepts that had just been worked out, I again thought about my next career change!

The product that was developing during the blitz analysis looked to me like something on a bubble gum wrapper. Circles with lines attached to squares were placed on a screen in the front of the room. Words like "logistics-unit," "planning-unit," and "demob-unit" were placed in those squares. The talk was, for the most part, something about which I knew little—ICS. I took copious notes, copied drawing after drawing (I was getting pretty good at circles), and slowly I began to understand the structure in which we were working and how InciNet was supposed to run. I began to see how complex, yet flexible, ICS is and how it can grow. Because computer programs impose structure, I began to see the size of the task. I also started to realize the frustrations involved in working on interagency applications. On December 10, 1992, the last blitz analysis meeting took place. After 4 months with InciNet, I knew something about what the ICS is and appreciated the interagency environment in which InciNet operates.

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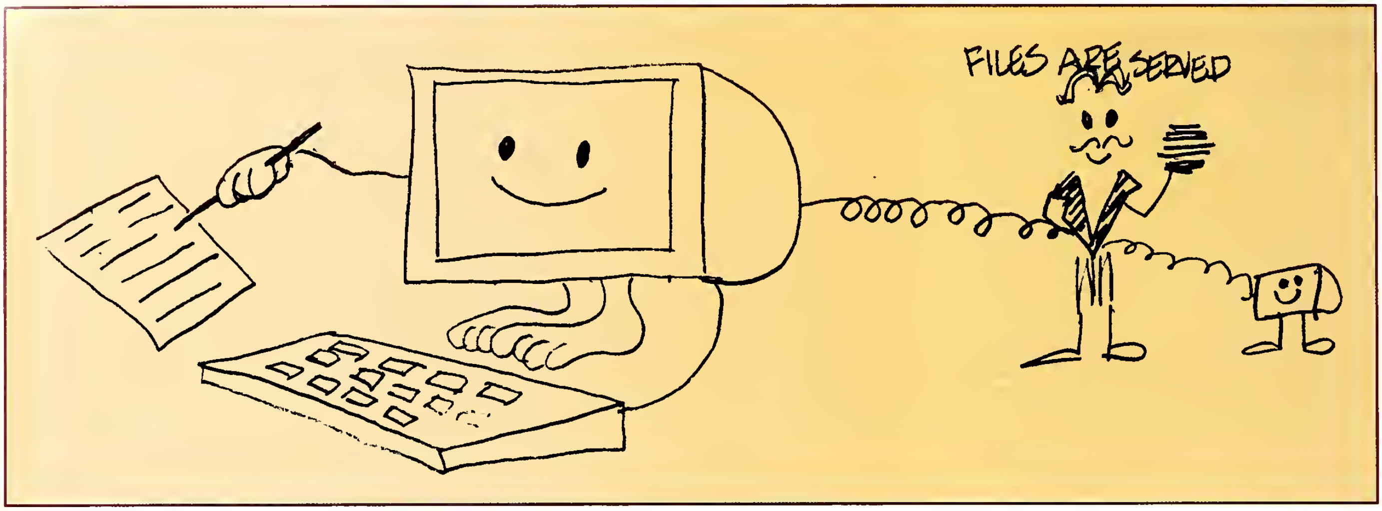

"The future of InciNet now lies in the field."

The System Is Tested

A test of the system was scheduled in Napa, CA. This was also my first look at the type of equipment InciNet would be running. The setup seemed simple. Standard telephone wires were laid from room to room at a hotel. On the equipment, a test incident (in which data had been preentered) was running. Besides a couple of geese swimming in the pond, there wasn't much to see. After the test in Napa, the InciNet Steering Committee met. I was there to represent the Forest Service on this committee. They decided to release a beta version of InciNet for the summer of 1993. The committee came to this decision for a number of reasons:

- Support for individual committee member travel appeared waning;
- National Wildfire Coordinating Group (NWCG) funds were being directed elsewhere; and
- The test at Napa seemed to show that there were no major problems running the program.

The steering committee decided it was time to release the first version. They talked about the logistics of caching the equipment. Briefly, they discussed software support. I went home thinking that word of product release would be happily received. Finally, there would be something to be talked about.

Beta Testing Meets Mixed Reactions

News of the beta release was met with mixed reaction. Complaints of specific problems and disagreements with the direction of the project seemed to increase. After an InciNet Steering Committee meeting in San Diego, CA, a second MS-DOS product was announced. Support problems were discussed here also. In late winter, the decision was made to cache InciNet at Missoula, MT, instead of Boise, ID. This too was met with mixed reaction.

When the hardware finally arrived, the InciNet software was loaded, and the kits were placed in special shipping containers. Everything seemed on track. The question of software support was still unanswered. The CDF agreed to provide support through the 1993 fire season. The season came and went. InciNet went to some fires. Reaction was again mixed. It was clear that a more effective way of entering data was still needed.

Sharing InciNet Opinions

It was decided that a "smart card" type of entry will be looked into and tested. Since there was no "real" software support for the MS-DOS version, a "forum-type" mailing list was established to share information on ideas, developments, and opinions. For Forest Service users, the list address is "InciNet-Forum:w01c." A long-term answer for support and maintenance of that program is still being sought.

Work has been completed on the Finance module, which is now in beta test. Version 1.5 of InciNet was released in July 1994. NWCG funding ends with the 1995 fiscal year.

InciNet's Future

The future of InciNet now lies in the field. InciNet may not be the ultimate answer to all ICS problems, nor fit perfectly into the ICS structure, but it seems to be a good starting point. I would like to see it used and evaluated by Incident Commanders. Subsequently, their input should be used to build on the InciNet foundation. ■

InciNet Used on Southern California Emergencies

Jim Nicholls

When major incidents such as wildfires, earthquakes, floods, and hurricanes occur, Incident Commanders are faced with the difficult task of managing large numbers of personnel and equipment arriving in a short timeframe and needing immediate direction and support. The nationally adopted Incident Command System (ICS) provides job descriptions and training for management and support personnel. Faced with overwhelming work loads, these personnel attempt to sort out resource availability and provide all necessary support as quickly as possible. A new tool provides incident personnel with automated assistance to make the necessary decisions quickly and efficiently. This tool is InciNet.

Background of InciNet

InciNet, as we know it today, began in 1990 as a cooperative venture between the National Wildfire Coordinating Group (NWCG) and the California Department of Forestry and Fire Protection (CDF). The product provides automation of many ICS functions and can be used by emergency response agencies at any level of government. InciNet's menus and "pick lists" ease the use of the product by ICS-trained fire personnel who possess minimal computer skills. The hardware is designed for extreme field conditions and has the flexibility to service an extensive incident base.

Jim Nicholls is a division chief for the California Department of Forestry and Fire Protection, Sacramento, CA.

InciNet

InciNet is an extremely large and dynamic data base that provides the incident staff with tools to manage incident information; in addition, it generates printed reports. To aid in the management of resources, orders are tracked from the time the Incident Commander requests additional resources through demobilization. InciNet also allows each unit to carry out its tasks as defined under ICS:

The Resource Unit can:

- Create and staff divisions, groups, and staging areas, generating Division Assignment Lists (ICS 204) in the process
- Check in resources upon arrival at the incident
- Form strike teams and task forces
- Assign overhead to sections, branches, and units
- Set operational periods

The Situation Unit can:

- Create and update Incident Status Summaries (ICS 209)

The Demobilization Unit can:

- Plan demobilization priorities based upon agency, time at the incident, travel needs, etc.
- Manage and coordinate releases with the dispatch center

The Supply Unit can:

- Receive shipments and manage the inventory
- Issue and track supplies and equipment
- Transfer supplies to other incidents or back to the providing source at the close of the incident

The Ground Support Unit can:

- Monitor all ground equipment for inspections, servicing, rental agreements, etc.
- Provide the Ground Support Vehicle Inventory (ICS 218)
- Manage its drivers and vehicles

The Medical Unit can:

- Prepare and update the Incident Medical Plan (ICS 206)

The Communications Unit can:

- Manage all radio systems and the frequencies assigned to the incident
- Prepare the Incident Radio Plan (ICS 205) with direct input to the ICS 204's

The Procurement Unit can:

- Create emergency equipment rental agreements
- Post shift tickets, fuel and oil issues, work orders, commissary charges, and miscellaneous charges

Continued on page 22

- Provide final invoicing for payment with full documentation

The Time Unit can:

- Prepare individual time records
- Post crew and individual shift tickets, commissary charges, and miscellaneous charges
- Print completed individual time reports, including payment information for casual hires

The Cost Unit can:

- Prepare daily and cumulative incident suppression costs
- Identify individual agency expenditures
- Break out costs for special purposes

Availability of Hardware and Software

InciNet can operate on one of two distinct computer platforms—DOS or UNIX. The DOS version is designed for a single user and runs on a notebook or desktop computer to support initial and extended attack-sized incidents. Both disks for use with DOS equipment and user manuals became available through the National Automated Cache System (NACS) early in 1995. This version can be run on most IBM-compatible 386 or faster computers possessing at least 20 Mb of free memory on the hard drive and at least 4 Mb of Random Access Memory (RAM).

The UNIX version, currently available through NACS, can be ordered by any agency through its regional coordinators. This software is used to handle large-scale incidents or any incident desiring full implementation and provides multiuser and multitasking capabilities. Many agencies are now acquiring the UNIX package to run on IBM-compatible PC's equipped with the necessary serial port cards that allow nonintelligent work stations to be slaved to the file server.

InciNet in 1993

For the 1993 fire season, NWCG trained a total of 51 Federal and State fire control employees to perform as "InciNet advisors." (The position is similar to the one ICS advisors used when ICS was first adopted.) InciNet advisors are trained to initialize the incident's data base and then provide hands-on training to staff on the scene. The objective for 1993 was to validate the program and provide field input for a better product.

The 1993 fire season was relatively slow until October, when InciNet was dispatched to the Marré fire on the Los Padres National Forest. While the program was not fully integrated into the incident, the basic product and protocols were validated. Then in November, with the rash of fires in southern California, InciNet was again called upon to provide support for numerous incidents.

Although designed to handle smaller incidents, the DOS version performed well in providing action plans supporting over 3,200 firefighters and staff working the Green Meadow fire in Ventura County for 10 days. It was also used without problems on smaller incidents such as the Box and Steckel fires and the Orange Show staging area. The UNIX system was used on the Ortega fire on the Cleveland National Forest and the Topanga fire in Los Angeles County. Although the systems were ordered late into the incidents, the tool still proved invaluable to the Planning Section chiefs, providing timely and accurate action plans. Incident staff agreed that there was no other way that the Malibu fire could have been managed.

Improved InciNet in 1994

In 1994, use of InciNet became more widespread, with both Federal and State ICS teams requesting the equipment for fires throughout the Southwest and West. Major work was done to improve the software and speed of the operating system during the winter of 1993. With improved program flexibility from 1993 and increased functionality, far fewer requests for changes were received and user acceptance dramatically improved. For instance, due to a vast decrease in the time requirements to provide the various reports and paperwork, the individuals staffing the various positions have become more proactive in their duties. The availability of the "sort" processes enhances resource information gathering and allows decisionmaking based upon verifiable information. In many cases, the transition from manually prepared forms to both on-screen and printed information dramatically changes the capabilities of a unit and provides new ways of improving operations.

InciNet in the Future

While version 2.0 was the final product of current development, plans are underway to provide ongoing product maintenance. Future enhancements and new functionality are feasible down the road due to the design and coding employed to date. As with any software product, InciNet will need to grow and change to meet new needs and procedures in addition to an ever-changing hardware environment. The key to total integration of InciNet into daily incident operations lies in the inclusion of the program and equipment into agency-provided training sessions and the use of the DOS version to preacquaint personnel with the program prior to use on an actual incident. ■

Changes at California's ITS[1]

Anthony P. Favro

Information Technology Services (ITS) of the California Department of Forestry and Fire Protection (CDF) underwent quite a few changes in 1993. As a result, ITS began 1994 with a somewhat unfamiliar name, a new office location, and a number of ambitious new projects.

New Section Name. It's taken awhile for those familiar with the section's former name, Electronic Data Processing (EDP), to get used to the ITS designation. The chief of ITS, Bryan Gillgrass, explained, "Information technology really says we're going to deliver information through the use of technology to help CDF do its job, whatever and wherever it may be."

New Chief. Gillgrass joined CDF in April 1993. He has been credited with bringing new ideas, new plans, and an overall new outlook to the section.

New Location. One of Gillgrass's first projects was to organize the move of ITS to a new location. His efforts reached fruition in September 1993 when ITS began to set up shop in its new offices. Gillgrass said, "the move has allowed our organization to be in one location for the first time in 5 years." The new location includes a much-improved office environment, a conference room, and, maybe most importantly, a true computer room that houses many of the file servers that tie CDF together.

In describing the new space, Gillgrass remarked, "This is an air-conditioned space that's designed and built just for the housing of computers." He compared the new computer room with the previous setup—where the servers were stored ". . . in a closet or in somebody's office, and you could run by and trip over a cord and possibly unplug the whole State." In addition, the move has allowed ITS to wire a building properly for local- and wide-area networks.

New Projects. Now that it is situated in the new space, ITS can address its large number of current and new projects. Primary among these is the creation of a 5-year Information Systems Strategic Plan. In addition, Gillgrass has been active in the development of an overall strategic plan for the department as well as one for the Management Services Division.

"We have had to ask some very pertinent questions," Gillgrass said. "We wanted to determine accurately the business needs as well as the overall strategies of the organization so we can find the appropriate information technology solutions. That's a big, big issue going on right now, and ITS has spent a tremendous amount of effort in doing this since I've gotten here."

Bryan Gillgrass, chief of CDF's Information Technology Section, stands next to some of the equipment now stored in the section's new computer room, designed specifically for the housing of computers. Photo: Anthony Favro, CDF, Sacramento, CA, 1994.

A major component of this planning process is a series of business process reviews—the bringing together of the automation, administration, fire protection, and forest practice sides of CDF to develop a common definition and understanding of them. "Then we determine where in that process automation can help.

Other ITS projects include the development of an automated All-Incident Emergency Activity Reporting System, the release of the second version of the InciNET system, and the upgrade of the statewide area network from analog to digital. ■

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[1] *This article, in part, was first published as "ITS—New Name, New Chief, Lots of Projects" in the January/February 1994 issue of "Communiqué," CDF's employee newsletter.*

CAHIS Helps Make the Skies Safer

Jon C. Skeels

During the past 10 years, aviation safety has become a major issue for natural resource agencies across the country. Agency personnel are becoming more aware of how aircraft maintenance, dispatch procedures, airspace conflicts, and ground hazard locations affect overall program safety and success. They realize that more aircraft (civilian, military, and government) are being flown than ever before. In addition, the public's use of small aircraft to visit areas where natural resource agencies are also performing aviation operations continues to increase.

CAN System Developed

A grassroots effort was begun in the early 1980's to develop a system that would help dispatchers and aviation managers document information about military airspace locations and airspace navigation for pilots. This effort led to the development of the Computer Aided Navigation (CAN) system. CAN was first used on several forests in the Pacific Southwest Region (Region 5) of the USDA Forest Service. As people realized its potential, CAN soon spread to more forests and other agencies across the country. The CAN software, written in BASIC, runs on a personal computer, using the DOS operating system as well as the agency's Data General system.

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> CAHIS serves a vital purpose in providing accurate, quick, and easily accessible information.

CAHIS Evolves

In 1988, representatives from several Federal agencies began studying how the benefits of CAN could be applied to a graphical computer interface such as the Bureau of Land Management's (BLM) Initial Attack Management System (IAMS). IAMS is designed to provide intelligence to help dispatch initial attack forces to incident sites and to assist dispatchers with aviation activities related to incidents and other aviation-related projects. Because IAMS requires the use of a network to transmit lightning-related data and electronic mail, Federal personnel developed plans to produce a stand-alone version of IAMS for use by agencies other than BLM. They also made a decision to incorporate the technology provided by the CAN system into IAMS. With this consolidation, the Computer-Aided Aviation Hazard Information System (CAHIS) came to be.

Maps and Overlays

CAHIS, an IAMS subsystem, runs within the Microsoft Windows environment using a graphical mapping system known as MAPS. MAPS is the map display and analysis component of the IAMS system; it displays data similarly to geographic information systems (GIS). MAPS includes a graphic display of selected overlays including the continental United States, natural resource agency boundaries, helibases, airtanker bases, Vertical Omni Radios (VOR's), military training routes (MTR's), special-use airspace, aeronautical obstacles, road systems, and geographical features (e.g., lakes and streams). In addition, more specific data such as street maps can be added to these overlays. It should be noted that since a network is not used in the stand-alone version, the lightning systems-related layers are not included.

Within MAPS, users can select any of the available overlays for display and determine attributes (e.g., color, shading, labeling) for display. MAPS also provides a zoom function that helps users select a geographic area at a closer scale (e.g., down to 1:64,000). The zoom feature is an effective way to create a view of a particular area (e.g., a user in Portland, OR, can place the northwest portion of Oregon in the center of a view at a small scale). Users can also develop custom maps and views of geographic areas and save them for later reference.

CAHIS performs an analysis of these overlays to locate aviation-related hazards (e.g., MTR's, SUA's, obstacles) and to identify VOR's, helibases, airtanker bases, and other support locations. CAHIS uses MAPS to provide an accurate display for visual reference and

analysis. In addition, MAPS provides distance measuring tools that allow the user to measure distances between any set of points on a map. Distance conversions are made available in statute and nautical miles as well as kilometers.

It is critical that the aviation data be accurate and current. Data from the Defense Mapping Agency (DMA) is published every 56 days in the form of the AP/1A and AP/1B documents. This data is updated electronically every 28 days and is available on CD-ROM. While the CAN system must be updated by hand with this new data (every 56 days), CAHIS is updated quickly using files extracted from the CD-ROM (every 28 days). This update is available to the field quickly using the Data General information retrieval system and other agency e-mail systems. This data is certified by the Federal Aviation Administration (FAA).

Benefits of CAHIS

CAHIS is beneficial to both dispatchers and aviation personnel. For example, CAHIS:

- Automates information formerly obtained by manual methods
- Contains certified, time-sensitive data from the DMA and the FAA
- Performs required calculations, thus reducing the occurrence of errors
- Contains current information updated in 28- and 56-day cycles
- Provides comprehensive and accurate information by integrating data from several sources

Current System Status

The final BETA test of the stand-alone version of CAHIS was tested at 27 Forest Service locations beginning in late November 1994. The system is currently available at all BLM IAMS units across the country. Once testing and the necessary system adjustments and enhancements are complete, the system will be available to all interested agencies.

Who Can Use CAHIS?

The system may be used by anyone—from dispatchers to aviation managers—both in emergency and nonemergency situations. All that is required is a personal computer with at least a 386 processor, 4 Mb RAM, 25 Mb of free hard disk space, Microsoft Windows 3.1 software, and a mouse.

Summary

Through CAHIS, agencies involved in incident and aviation management have valuable opportunities to share information. MAPS link to external data (e.g., DMA) and other Federal agency data provides a one-stop repository for critical geographic- and aviation-related graphic data. Using information from a wide variety of sources increases the accuracy of the data overall because each overlay source is the best possible for the particular set of data. In addition, each agency that contributes information also maintains an investment in the system.

The Future of CAHIS

Feedback from users of CAHIS will help to further develop, customize, and enhance this new and dynamic system. All users have the opportunity to provide feedback to help maximize the effectiveness of CAHIS.

CAHIS has grown and developed into an important dispatch and aviation tool. It serves a vital purpose in providing accurate, quick, and easily accessible information

Cover of brochure about CAHIS.

to pilots, dispatchers, ground crews, the FAA, military installations, and other agencies involved in natural resource management.

In May 1994, an interagency brochure became available to anyone wanting more information on CAHIS. The brochure provides managers with general information on what CAHIS does. It shows screen examples and computer requirements and lists people to contact for further information. Copies of this brochure can be obtained from Jon Skeels, Rocky Mountain Region, P.O. Box 25127, Lakewood, CO 80225 or telephone: 303-275-5746; or IAM Support Group, National Interagency Fire Center, 3905 Vista Avenue, Boise, ID 83705-5392. ■

DLMS: An Aviation Management System

Lynn C. Thomas

The Demand Logistics Management System (DLMS) is an automated aviation system designed to establish asset management and aircraft dispatching capabilities. It will directly support Federal agencies in meeting the requirements of the Office of Management and Budget's circulars A-126 and A-76 for postmission reporting.

> The DLMS is an automated system that not only helps Federal agencies dispatch aircraft needed for specific missions but also supports the preparation of cost-analysis and other reports after missions are accomplished.

From a Proven System

The DLMS is a derivative of the Navy Air Logistics Information System (NALIS), which is a centralized system to assess what types of aircraft should be used for necessary missions and to allocate aircraft. Since implementation of the NALIS, the Navy has reduced its fleet by 50 aircraft while increasing its transport capability and has seen annual operating cost savings of over $100 million.

The General Services Administration (GSA) evaluated NALIS as a desirable tool for Federal agencies and took the opportunity to sign a memorandum of understanding with the Navy to include Federal civilian agency requirements in a new design. The DLMS is the result of this joint venture.

Available on Two Formats

The project is progressing in two parallel design efforts. One version is an MS DOS-based design called the "Clipper," usable on a personal computer. Features of this version will include:

- Tracking of airlift requests, flight schedules, and postmission reports
- Full A-126 reporting with basic cost analysis
- Flexible reporting
- User-friendly menus
- Easily modified tables

The minimum system requirements to run the Clipper version will be a 386 DOS-based PC with 4 Mb RAM, 10 Mb available disk space, and VGA graphics capability. It can also run on a comparable laptop computer. Files may be transmitted over telephone connections via a modem and a third-party software package.

The second design effort is an Oracle-based relational data base version, targeted at users with a large fleet of aircraft. This version will have even more features than the Clipper version and will be capable of handling larger data bases. Some agencies, especially those that are already running Oracle applications, may want to migrate from the DOS version to the UNIX version to gain the additional features and sophistication of that system.

The minimum system requirements to run Oracle applications are a computer with a UNIX operating system capable of running Oracle 7 Relational Data Base, memory sufficient for the number of users on the system (16 Mb recommended minimum), and hard drive capacity sufficient for the desired amount of record storage. In addition to those mentioned above, DLMS features:

- Generic aviation data and reporting standards
- Automated scheduling tools for both tactical and administrative flights
- Full documentation of each flight by leg
- Modeling and real time analysis that can:
  - Justify the use of government aircraft
  - Reflect aircraft operating costs
  - Conduct required cost comparisons
- Aircraft management, including
  - Procurement (missions flown and not flown)
  - Distribution for most effective use
- Aircraft dispatching and use tracking
- Incorporation of many of the Aviation Data Management (ADaM) program features

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- Temporary remote coordination on a laptop or notebook computer
- Passenger manifest and recall
- Travel cost and comparisons
- Project codes for capturing mission data
- Aircraft costing by tail number

Evaluating To Improve

In August 1992, a demonstration of the DLMS was given to the Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), and the USDA Forest Service. In September 1992, the DLMS Standardization Task Group was formed through the Interagency Committee for Aviation Policy (ICAP), Management Data and System Subcommittee. The task group members began working through GSA with the Navy development team. Functions of the group included:

- Reviewing suggested program modifications and enhancements
- Defining and applying system design criteria
- Performing software quality reviews and testing
- Providing system demonstrations
- Assisting in user training

In October 1993, the alpha test of DLMS began at the Southern Area Coordination Center (SACC) in Atlanta, GA, and in the National Interagency Coordination Center (NICC) in Boise, ID. In January 1994, the beta test version was released to the task group. By April, DLMS was ready to be demonstrated in Denver, CO, at the National Coordinators' meeting. Copies of the DLMS program were given to eight Geographic Coordination Centers for further testing and providing feedback to the task group.

How DLMS Works

Requestor alerts dispatcher of service needs.

DLMS creates a demand file:
- Departure and arrival points
- Time frames
- Passengers and/or cargo: size, type
- Priority and urgency
- Frequency of use

DLMS makes flight assignments:
- Reviewing
  - Aircraft capability requirements
  - Aircraft availability
  - Distance and cost file
  - Location resection file
  - Crew duty file
  - Maintenance file
  - Contract and/or charter aircraft file
- Optimizing aircraft options
- Performing OMB circular A-126 cost comparisons
- Capturing and archiving management data

DLMS is responsible for:
- Assigning aircraft type
- Specifying route
- Determining departure and arrival times
- Satisfying all or part of request
- Recording capacity remaining
- Pre-loading fixed routes that can/cannot be modified
- Notification of tasks to
  - Aircraft operator
  - Requestor
  - Passengers
  - Airfield operators

DLMS provides aircraft management with the following:
- Mission reports
- Actual vs. scheduled performance reports
- OMB A-126 and A-76 reports
- Scheduling efficiency
- Justification for present and/or new aircraft
- Bulletin Board and help desk support
- Information for Federal Aviation Management Information System (FAMIS) reporting

DLMS Made Available

In late June 1994, the Navy turned over the Clipper Version 1.0 software of DLMS to GSA. In August, an interagency DLMS workshop and training session was held in Washington, DC. Agencies represented included the Forest Service, Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), Department of the Interior's (DOI) Bureau of Reclamation, Department of Transportation's (DOT) Federal Aviation Administration (FAA), Department of Treasury's Bureau of Alcohol, Tobacco and Firearms (BATF), and the Department of Justice's Immigration and Naturalization Service (INS).

A second workshop and training session was conducted in December with the following participating agencies—the Forest Service, DOI's Bureau of Land Management (BLM), and Office of Aircraft Services (OAS), Department of Energy (DOE), and DOT's FAA.

The DLMS software and users manuals were provided free to participating agencies. Assistance in installation and training may be requested through the ICAP Management Data and Systems Subcommittee and the Interagency Task Group. Further suggestions for modifications or improvements to the Clipper DLMS will be evaluated through the Interagency Task Group and performed by GSA. ■

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